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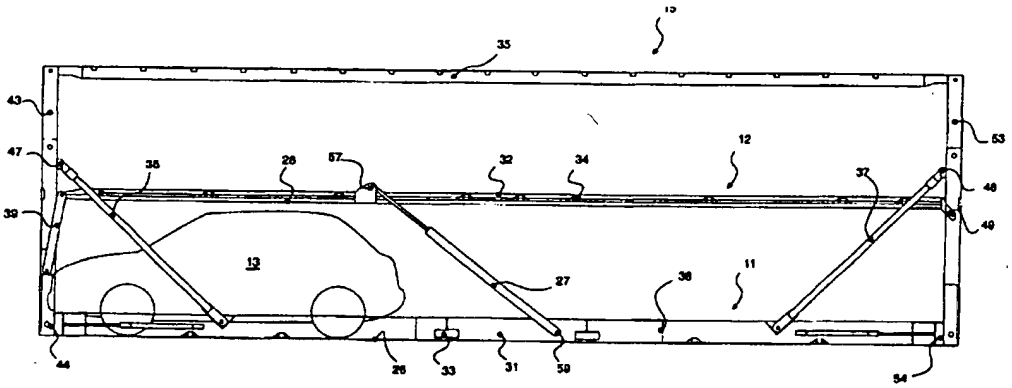

(57) Abstract

A multi-deck, collapsible, container (10), for general purpose cargo or bespoke vehicle carriage, has a supplementary deck (12), movably-mounted on upright supports (13), upon a base deck (11), in an open-plan, space-frame array, to enable tiered cargo stacking, whilst preserving roll-on/roll-off end loading and unloading access; the supplementary deck may itself be segmented (16), with differential entrained mobility for diversity of load handling configurations, including multiple individual tilting of discrete loads, such as long vehicles.

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Multi-Deck Container

This invention relates to (freight) containers, for transport and shipping, and configured for the transportation of motor vehicles and general cargoes.

Whilst containers are standardised - in overall profile shape, size and tare or loading weight capacity - there remains scope within the load envelope for more adaptable loading and storage configurations.

Bulk containerised shipping of multiple discrete cargoes of uniform character, such as (individually-mobile) motor vehicles, is a case in point.

Broadly, objectives may include high packing density, multiple and diverse vehicle carrying capacity.

Considerable sophistication in vehicle packing and stacking has evolved with purpose-built (roll-on/roll-off) lorry chassis and carriage transporters and trailers, respectively for road and rail transport.

Whilst high-stacking densities and so vehicle capacities have been achieved, the loading configuration has not necessarily been compatible with containerisation standards - and thus inter-modal (ie from land road/rail/sea/air shipment) has not been practicable.

Nor have many of the constructional techniques of bespoke transporter or carriage chassis been readily convertible to container construction - not least where container weight has to be minimised and, to reduce empty-return shipment costs, container volume itself.

In container construction, a balance must be struck between rigidity, load-bearing strength and 'passive' non revenue-earning weight or volume.

Redundant 'voids' around loads are wasteful of load volumetric capacity.

Thus high packing densities, consistent with ease of load access, for (sequential) loading and unloading, are desirable economically.

Flexibility in re-configuring the load space, to adapt to individual cargoes and minimise such voids, is also desirable, without undue structural complexity.

Some aspects of the present invention are concerned with multi-level or layer containerised vehicle storage.

Various attempts have been made to convert standard panelled wall containers for general purpose freight, by the introduction of additional platforms and supports.

Such provision is itself space-intrusive and introduces a passive weight penalty.

Moreover, the standard container capacity is generally inadequate, with restrictive load height constraints incompatible with multi-tier vehicle storage, without elaborate relative positioning or inter-nesting of vehicles, encumbering loading and unloading.

Nor is there provision for a compact return-empty (re-) configuration.

According to one aspect of the invention
a container comprises
a plurality of relatively movable decks,
mounted upon a support structure,
for differential relative deck positioning and orientation.

Desirably, for vehicle transport, end access (through-passage) aperture/clearance, is provided between end-supports, for loading vehicles on to either load deck.

The load support areas of the base and supplementary decks may be generally equivalent, to achieve an overall double-load capacity.

More specifically, an elongate rectangular plan form typifies container standardisation.

The supplementary deck may be fragmented, to allow differential relative movement - and thus its re-disposition in other loading/unloading and carriage configurations.

Preferably, the support structure comprises (longitudinally-spaced), pivoted posts or struts,

enabling the supplementary deck to collapse upon the base deck, into an overall collapsed container of minimal depth.

This collapsibility and stacking of collapsed containers enables the storage and transportation of multiple, say five or six, collapsed containers, in much the same load area 'footprint' as a single container.

The base and/or supplementary load platforms may lie between foldable/collapsible end posts.

Thus, for example, each end support structure may comprise a transversely-spaced pair of posts or struts, hinged to the (base) platform (longitudinal) edges, so not account for much, if any, of the collapsed height.

The support posts or struts are conveniently disposed at corners of a rectangular base deck.

Additional bracing and support posts or struts, desirably in symmetrically opposed pairs, transversely across the decks, may be fitted along the (longitudinal) sides of the base deck/platform - to supplement the end supports.

In one configuration, intermediate support post or strut pairs are located at corners of a notional rectangle, of equivalent dimensions as a standard container, of some 12 metre (40ft) length [width 8ft].

With such a default intermediate support post array, end support posts are conveniently disposed at the corners of a rectangle, equivalent to one of the larger sizes of container now adopted in certain container systems e.g. of 14.3 metre (48ft) length.

This duality of end and intermediate support posts enables stacking and handling of differentially sized or proportioned containers, in a common load bay.

Multiple posts pairs of the pairs may be disposed to lie folded inside one another, or in folded succession along the base deck.

Posts may be fitted, through a balanced pivot mounting, on the supplementary deck, for ease of manual deployment.

Detachable 'plug-in' post fittings may also be employed.

Overall post disposition may reflect the positioning of container lift fittings, such as cable eyes.

Post latches and stays can ensure that the posts remain erect, under the design loads, and in alignment for operation of the supplementary deck.

Mechanical guidance may be incorporated for controlling relative movement of the supplementary and base decks in elevation and lowering.

Thus, for example, inter-fitting deck end rollers and post guide tracks may be used.

'I'- channel, or pinned inter-fitting 'L'- section, structural beams with guidance flanges, may be used as (longitudinal) deck stringers.

Deck support and bracing posts may be telescopic, to accommodate relative deck movement.

Lifting jacks are desirably co-operatively disposed alongside, in juxta-position, or even within support posts - to act directly between decks or indirectly upon the posts themselves.

Multi-position, releasable pivot connections are desirably provided at the supplementary deck ends, to allow deck inclination, in one or more senses, and to accommodate temporary deck disconnection when spanning diagonally between end posts.

Thus, say, a retained guide-roller fitting between deck and support post could allow travel of a deck end up and down the post alongside deck tilt about the local point of connection.

An auto-detent facility could be fitted at prescribed deck end positions in the end support posts, to temporarily lock the deck end, upon a given travel along the posts.

To facilitate deck lift and preserve guidance and alignment to prescribed inclinations or tilt from the horizontal, one or both ends of the platform may be fitted with rollers or wheels, to run in tracks in the decks or support posts.

On the posts at (at least) one end, an inward track extension routing may be fitted, on guide

arms, to carry that end of the supplementary deck as it is tilted - thereby compensating for what would otherwise be a between end post span deficiency.

The other deck end could remain travelling in the corresponding end support posts.

Alternatively, supplementary track extensions could ensure that rollers remain engaged in various deck inclinations.

The deck movement guide wheels or rollers could be mounted upon swinging links, to maintain track engagement throughout deck inclination.

In loading and inter-positioning decks, various operational sequences could be employed.

Thus, for example, the supplementary deck could be loaded in its lowermost position, horizontally levelled, and overlying the base deck.

The supplementary deck could then be raised level, for example by a crane of a container handling depot, or with container mounted jacks or motors.

Alternatively, the supplementary deck - or a differentially movable local (say, end) portion thereof - could be inclined, as a loading ramp, with one end at a height to accommodate an underling line of vehicles on the base deck.

The other end could remain as a ramp entry point at the base deck, so that a full complement of vehicles can be driven in succession up the ramp and secured in place upon the supplementary deck.

Subsequently, the supplementary deck could be levelled to a required height by raising the lower end - and, if necessary, lowering the higher end.

For larger/heavier vehicles, such as trucks, the supplementary deck may remain resting upon the base, as a stiffener and load bearer, in an integrated deep base section, to support a single line of (heavy) vehicles, occupying most of the container internal depth.

The supplementary deck is conveniently raised with integrated power lift facility, such as hydraulic rams, screw jacks or cable winches.

Rams could be powered by on-board hydraulics - optionally interfacing with an external hydraulic pump line-pressurising facility, such as a tractor power take-off.

In a particular construction, an opposed pair of single-acting, singly-extendable hydraulic rams, (ie with a fully-extended span some twice the length of the fully contracted rams), are disposed (longitudinally) asymmetrically between the load decks.

In this arrangement, one end of the supplementary deck may be latched or entrained - and effectively hinged - at base level, for example by engagement of rollers in a guide track.

The opposite end is raised beyond the required height for a second line of vehicles to be accommodated below, and vehicles are driven up the inclined deck ramp.

A deck restraint is released, allowing deck levelling and re-distribution of the weight of the loaded vehicles.

At loading, the supplementary deck weight is asymmetrically distributed, by the asymmetric location of the rams.

This in turn aids the levelling operation of lowering the higher end to a required height for an underling vehicle line, whilst raising the lower end that height with minimum power requirement.

Effectively this configuration allows smaller lift rams to be used, because they are raised to their full extension, or near full extension, while the supplementary deck is unloaded - and hence there is less deck weight to be moved at that time.

The supplementary deck is thus effectively pivoted on the rams - and again restraint may be implemented selectively to control or restrict that pivoting.

By selective ram empowerment and deck end restraint a range of different deck elevations and orientations can be performed.

A program instructional sequence or automated control may be provided to assist untrained operators in performing the necessary loading/unloading ramp tilt sequences.

Aside from *integral* lifting devices, such as hydraulic rams, (screw)jacks and (cable) winches, reliance may be placed upon *external* lifting means, such as loading cranes, or load lift/transport vehicles.

In addition to, or instead of tilting the supplementary deck in its entirety, only a limited end portion thereof may be tilted to form a loading ramp.

Similarly, localised portions of the supplementary deck may be tilted differentially and progressively, to achieve a multi-stage loading ramp - say initlally steeply, but becoming gradually more shallow remote from the loading end.

Alternatively, supplementary deck portions may be tilted into a longitudinally-spaced series of parallel 'mini-ramps', with greater individual (vehicle) length capacity than could otherwise be accommodated if the ramps were aligned end-to-end - enabling multiple storage of long vehicles to a greater overall capacity.

Provision may be made for sequential loading and tilting (re-)orientation of such mini-ramps - for example by movement of an overall supporting supplementary ramp chassis as a whole.

In practice, latches, clamps, brakes and stops may be provided, for supplementary deck position control and hold - especially when in a full load carrying condition, such as a level mid-elevated position, parallel to the base deck.

Span-wise movement of (intermediate) deck ends, upon inclination or differential elevation, can be accommodated by swinging links, movements of rollers in guide track extensions, or the like.

An overall roof element, spanning the overlying decks can be fitted.

Such a roof element can be lifted and lowered by movement of the supplementary deck to a temporarily greater height at the (upper) ends of support posts or struts.

Any or each of the decks may incorporate parallel tracks, to support the wheels of the vehicles.

Indeed deck inter-fill may be sacrificed in favour of a lattice of deck beams, comprising vehicle guide tracks as longitudinal stringers with spaced transverse connecting members.

Complementing the vehicle protection afforded by an optional roof, side curtains may be fitted.

A roof may be supported on the collapsed overlying supplementary and base decks and can be raised by the motorised jacking before the container is loaded, positioned on supports and latched in place.

The roof itself may be a load-bearing deck, with vehicle guide tracks - for three (overlying) lines or stacked rows.

With a load-bearing roof, the supplementary (intermediate) deck position may be re-adjusted.

The base, platform and roof decks may embody a longitudinal camber, to different extents.

Thus, the roof desirably has the greatest camber, whilst the platform an intermediate camber and the base a minimum camber.

A typical camber may be of the order of, say, 30-40mms for the base, 60-80mms for the platform and 120-160mms for the roof.

These dimensions represent the height variation at the centre of the length, above a plane containing the ends.

The camber may be created using structure for these three parts which, whilst sufficiently rigid for the load-bearing required (in the case of base and platform), has a natural 'free' condition providing the camber.

The object of the camber is to provide additional height 'clearance', allowing for rise and fall of vehicle bodies upon loading and traverse of transverse chassis members in the guide tracks.

This rise and fall reflects the steep transitional angles involved - particularly upon deck tilt and levelling.

The camber is reduced when all of the vehicles are loaded. Indeed, the (re-)distributed vehicle weight or design load may be used to extinguish deck camber.

The roof may be of much lighter construction, so that its camber may be reduced by use of (tension) straps or ties, adjusted by turnbuckles or the like.

Camber aside, the base deck and any roof are desirably inter-connected at a plurality of points after loading and levelling, to 'rigidise' the overall container.

The loaded container can thus withstand severe jolting, such as through heavy seas in container shipping.

Conventional anchorage points can be provided for securing vehicles in place.

The container can be provided with fork entry points, for use by fork-lift trucks.

Desirably, these are located asymmetrically of the length, with alternative openings available.

Each fork entry point may be an aperture in side member of the base deck, and aligned with a generally tubular member extending transversely between side members, to preserve the vehicle wheels from fork contact.

These transverse fork reception tubes may lie over or through vehicle guide tracks, creating a minor obstacle and disruption to vehicle loading and unloading.

Nevertheless, this is preferable to locating the tubes below the tracks.

Alternatively, the tubes may be discontinuous and so interrupted by the guide tracks.

Vehicle guide tracks are embedded into the respective deck structures, to make best use of the available height.

This reflects the standard height of containers in international shipping, which is barely adequate for two rows of vehicles - depending on vehicle height.

Height/depth considerations affect adjustable camber for extra headroom when vehicles

traverse the fork tubes.

With loaded vehicle wheels between these tubes, the enhanced (loading) headroom is redundant, and deck camber loss reduces overall height to allowed standards.

Generally, the base deck construction incorporates relatively deep longitudinal side stringers, supporting respective tracks, intermediate deck supports and inter-coupled by transverse fork tubes.

The container may be braced by generally diagonally extending ties, for example configured as gates or doors, foldable between the end structures.

Such end doors may have a movement arc of 270° - from folded-back positions for vehicle entry, to positions where they close off the container ends.

However, although the containers are of certain standard sizes, shipping practice allows vehicles to project somewhat beyond the containers.

Thus, end gates may accommodate, for example, modest vehicle nose or tail projection.

Bracing may be provided along the container sides.

Aside from dedicated vehicle carriage as aforesaid, the invention is more widely applicable to general cargo carriage.

Thus, in such a cargo configuration, a base (deck) platform is fitted with posts extending upward from the base, and supporting a movable supplementary (deck) platform.

This supplementary platform can be raised from a lower position, at which it cooperates with the base platform to support cargo, to a relatively higher position, at which a supplementary layer of cargo can be supported above that upon the base platform.

There now follows a description of some particular embodiments of the invention, by way of example only, with reference to the accompanying diagrammatic and schematic drawings, in which:

Figures 1A through 1D show a multi-deck vehicle shipping container, according to the invention, with a supplementary load deck in various loading, unloading, roof positioning and load carriage configurations; more specifically:

Figure 1A shows a supplementary load deck set at a level intermediate load carrying height, generally parallel to a base deck, with an overlying roof;

Figure 1B shows a ramp (end) portion of the supplementary deck of Figure 1A, inclined for loading, unloading or storage of longer vehicles, with a residual level portion;

Figure 1C shows the supplementary deck of Figures 1A and 1B inclined or tilted as a whole, for loading/unloading;

Figure 1D shows the supplementary deck of Figures 1A through 1C lowered level as a whole, to overly and integrate with the base deck as a re-inforced (dual) deck assembly;

Figures 2A through 2F show the multi-deck container of Figures 1A through 1D in various stages of erection and storage; more specifically:

Figure 2A shows a collapsed container, with a supplementary deck overlying a base deck and lowered deck (end) supports;

Figure 2B shows several collapsed containers of Figure 2A stacked upon one another;

Figure 2C shows an initial stage of erection of the collapsed container of Figure 2A, with deck end location in deployed (supplementary) deck (end) supports;

Figure 2D shows a subsequent stage of erection of the container of Figures 2A and 2C, with a supplementary deck, carrying a roof, raised at one end upon supports;

Figure 2E shows a further stage of container erection to that of Figure 2D, with a supplementary deck fully raised level upon supports, to position the roof;

Figure 2F shows a subsequent stage of container readiness, to that of Figure 2E, with the supplementary deck inclined as a whole, beneath the erected roof, to form a loading/unloading ramp;

Figure 3 shows, in more detail, a longitudinal side elevation of a variant of the multi-deck container of Figures 1A through 2F, with lift rams and deck end articulated linkage;

Figures 4A and 4B show in more detail a supplementary deck structure; and more specifically:

Figure 4A shows a deck plan view, with end location rollers;

Figure 4B show a deck side elevation;

Figure 5 shows a perspective view of a variant of the multi-deck container of Figures 1A through 4B, with end-bracing;

Figure 6 shows a general cargo-handling variant of the multi-deck container of Figures 1A through 5;

Figure 7 shows, in more detail, a transverse section of a constructional version of the multi-deck cargo container of Figures 1 through 6, with inter-fitting decks in a collapsed container condition;

Figures 8 through 12 show a twin deck vehicle container, without roof structure, in different load carriage and loading/unloading configurations; thus more specifically:

Figure 8 shows a supplementary deck lowered level upon, to integrate with, a base deck, allowing (level) vehicle loading/unloading;

Figure 9 shows a fully inclined supplementary deck, with a vehicle loaded upon a localised tiltable portion at one end;

Figure 10 shows the inclined supplementary deck of Figure 9 partially levelled, but leaving a residual deck portion, carrying a vehicle, tilted out-of-line;

Figure 11 shows the supplementary deck of Figure 10 reset to an inclined ramp, but leaving a residual deck portion, carrying a vehicle, tilted out-of-line;

Figure 12 shows the supplementary deck of Figures 8 through 11 levelled and set at an

intermediate load carriage height, allowing two overlying lines of vehicles, with the exception of a tilted end portion;

Figures 13 through 17 show a roofed variant of the container shown in Figures 8 through 12, with some general equivalence in loading configuration and sequence; thus more specifically:

Figure 13 show a roofed version of the level collapsed deck configuration of Figure 8;

Figure 14 shows a roofed version of the inclined supplementary ramp configuration of Figure 9;

Figure 15 shows a roofed version of the inclined supplementary ramp configuration of Figure 10, with a vehicle mounted on a tilted ramp segment penetrating the roof line;

Figure 16 shows a roofed version of the inclined supplementary ramp configuration of Figure 11;

Figure 17 shows a roofed version of a multi-tilted load configuration, as a derivative of the single tilted load variant shown in Figure 12;

Figure 18 shows a detail of a supplementary deck end multi-position, pivot support - through a pinned roller guidance fitting;

Figure 19A shows a pinned dual inter-fitting 'L'-section deck beam configuration;

Figure 19B shows a collapsed version of the dual 'L'-beam of Figure 19A; and

Figure 20 shows (temporary) extreme deck mobility, for loading/unloading.

Referring to the drawings, a multi-deck (shipping) container 10 has a base deck 11 and a relatively-movable, overlying supplementary deck 12.

The supplementary deck is carried upon the base deck 11 by an array of support posts or struts 14, disposed principally at the (common) corners of an elongate rectangular plan layout.

The container 10 overall has a generally open-plan, space frame structure of minimal passive weight or intrusive bulk.

In a vehicle shipment variant, the container 10 is configured for end-loading or unloading, through access ways 30 between the support posts 14 at one or both ends, as shown in Figures 1C and 1D.

An optional roof section 15 overlies both the base and supplementary decks 11 and 12, and may carry (lightweight) side-screen, curtain-walling 72 (shown in Figure 5).

The roof 15 may itself be load-bearing in some variants, to allow another (third) line or layer of cargo - given the necessary 'head-room' in the container park or stack.

Indeed, according to cargo and available load space, additional (relatively-movable) decks may be fitted upon a common base deck, possibly using common supports.

Generally, the supplementary deck 12 is movable between a fully lowered and raised (level) positions, and can be tilted to a desired inclination or levelled, using a common lift mechanism, not detailed in Figure 1, to convey that diverse internal or external means may be employed.

Thus, the Figure 2 variant described later, employs on-board hydraulic actuator rams 27.

In its fully lowered (level) position, the supplementary deck 12 integrates structurally with the base deck 11, as shown in Figures 1D and 7.

This allows maximum load height capacity within the container, and also maximum load weight - for larger vehicles, such as trucks or vans 19.

An intermediate (level) position of the supplementary deck 12, as shown in Figure 1A, allows two discrete (mutually-overlying) lines or layers of cargo, such as cars 13.

In between its two extremes of (level) raising or lowering, the supplementary deck 12 may be inclined as whole, as shown in Figure 1C.

In that (intermediate) inclined configuration, one end of the supplementary deck 12 is held at an intermediate (approximate midway) position on support posts 14 at that end.

Releasable pivot inter-connections 17 with end posts 14 may be used at one or both ends of the supplementary deck 12, as shown in Figure 18.

The other end of the supplementary deck 12 rests upon or merges with, by lying within, the base deck 11, allowing uninterrupted load transition between base and supplementary decks 11 and 12.

In some variants, as shown in Figures 8 through 17, a supplementary deck 112 may be inclined in either sense in relation to a base deck 111 - albeit with attendant complexity in lift and position mechanism, described later.

Additionally, the supplementary deck 12 may itself be segmented into multiple, differentially-mobile, (albeit mutually-entrained) supplementary deck portions or segments 16.

This facility allows, say, an end portion 16 to be tilted out-of-line with the majority of the supplementary deck 12, about a hinge joint 18, to assist loading, unloading, or long load carriage, as shown in Figure 1B.

In some variants, as shown in Figures 12 and 17, supplementary deck 112 segmentation is used for enhanced vehicle packing densities - particularly with different vehicle lengths, and individual vehicles of exceptional length.

As shown in Figure 2A, the container 10 may be collapsed as a whole, for economy of (empty-return) transport and storage.

In one configuration of collapsed container 20, the entire (level) supplementary deck 12 is lowered, to lie level upon, or even integrate with, the base deck 11 - by disengaging and folding support posts 14 and retracting opposed hydraulic actuator rams 27.

Any roof section 15 is also collapsed upon the stacked supplementary and base decks 12, 11 - as shown in Figure 2A.

An aligned stack 22 of uniform collapsed containers 20 is shown in Figure 2B.

Aside from their passive weight, inter-deck ties or latching may be used to couple together

successive individual collapsed containers in such a stack 22.

Figure 2D shows an initial container erection stage from the collapsed condition of Figure 2A, in which end posts 14 are folded, about end pivot mountings 21, on the base deck 11 and locked upright at the four corners of the base deck 11.

Subsequently, as shown in Figure 2C, the intermediate deck 12, carrying any roof deck 15 thereupon, may be raised - to the full (roof-carrying) height of the support posts 14, initially by raising one end with actuator rams 27 - using a captive 'roller' end mounting 23 to tilt the supplementary deck 12 as a whole.

The lower end 24 of the supplementary deck 12, with its base pivot connection 21 disengaged, can then be raised - again to the full strut 14 height - to level the deck 12 overall at roof height, whereupon any roof section 15 can be secured in position upon the posts 14, as shown in Figure 2E.

With the roof 15 secured in place, the supplementary deck 12 can be lowered to an intermediate loading position, some mid-way up the posts 14.

With its strut inter-connection 23 disengaged (or at a low end extreme of guide track travel) one end 25 of the supplementary deck 12 is fully lowered to the base deck 11.

The other end 24 is fastened at intermediate pivot mountings 25 upon the posts 14 at that end, to form an inclined, drive-up/down, loading ramp - as shown in Figure 2F.

Figure 3 shows in more detail, the structure and disposition of elements in a roofed (collapsible) multi-deck container, with supplementary deck mobility, using articulated deck end linkages 39, 49 with support posts 43, 53.

The base deck 11 has longitudinal chassis rails 31 at each side, bridged by transverse cross-members 38.

For vehicle carriage, guide trays 26 overlaying the cross-members 38 may be fitted.

Similarly, the supplementary deck 12 has longitudinal chassis rails 32 at each side, bridged by transverse cross-members 34.

Again, for vehicle carriage, guide trays 28 overlaying the cross-members 34 may be fitted.

A pair of (dis-engageable) diagonal bracing posts 36, 37, with releasable end fittings 47, 48, are connected between end deck support posts 43, 53 and chassis rails 31.

An opposed pair of (supplementary) deck operating (hydraulic actuator) rams 27 is disposed between off-centre positions 57 on the supplementary deck chassis rails 32 and longitudinally-offset positions 59 on the base deck chassis rails 31.

The ram positioning offset from the supplementary deck 12 centre of gravity facilitates deck counterbalancing for tilt action.

The rams 27 are used co-operatively, in conjunction with articulated end linkages 39, 49 in the Figure 3 variant.

Alternatively, in the Figures 8 through 17 variant, deck end location is through multi-position pivot joints, selectively engageable in preset locations in the support posts - and generally referenced Jx and Jy, for the opposite ends of the supplementary deck 112.

Figure 18 shows an example of Jx, Jy structure in more detail.

A roof deck 115, with longitudinal deck beams 135, and which may serve as an optional additional load-bearing deck, surmounts and is pinned or latched to the upper ends of corner posts 114.

The guide arms 153 can be combined with travelling pivot joints, such as Jx, Jy - to compensate for a short-fall in between-post span of the supplementary deck 112 when inclined.

This allows (tilting) mobility of the supplementary deck 112, through the rams 127, independently of the base deck 111.

The end posts 143, 153 may themselves be segmented and/or telescopic, to facilitate their collapse upon and (re-)integration within the base deck 111.

Base mountings at the feet of the posts 114 respectively, allow some lateral displacement, to facilitate unlocking, folding and collapse - and may embody a counter-balance tensioning spring, to cushion and relieve the post (re-)orientation loads, for manual operation.

The base deck rails 131 embody slots or enshrouded pockets 133, for the insertion of fork lift truck tines, to facilitate base deck 111 manoeuvring with external lifting effort.

According to the access required, a container end may be temporarily or permanently closed, by in-fill panels between deck support posts, for increased rigidity and strength.

In the Figure 3 configuration, the left-hand end could be regarded as the openable (albeit with optional door closure) loading/unloading access end, in relation to which the supplementary deck 12 tiltable to form a ramp; and the opposite right-hand end as closed.

Figure 5 shows additional inter-deck diagonal end-bracing 67 and supplementary side posts 63, with diagonal bracing arms 69, forming a box cage, to stiffen the overall container structure.

The bracing 67 may form a hinged end gate, which can be swung open to allow roll-on, roll-off vehicle access through the container ends.

A removable, deployable side-screen, curtain wall 72 is tethered from the roof 15 to the base deck 11 alongside the load space.

A multi-deck configuration is more widely applicable to general loads and a cargo version is shown in Figure 6.

Conversion between loads - or indeed dual-purpose storage - is also feasible.

In Figure 6, a general-purpose supplementary cargo deck or platform 82 is shown raised and secured to end posts 84 by releasable pin latches 83.

The supplementary platform 82 can be supported at a variety of heights, and can be inclined or levelled, as described and shown for the vehicle version.

Multiple discrete fastening positions 88 are provided along the posts 84, for selective

deployment according to required platform 82 positioning.

For increased overall load capacity, the supplementary platform 82 and a corresponding base platform or deck 81, can be braced together at a position intermediate the end posts 84, by links 89.

Posts 84 can be connected together by top rail 85 of a roof structure 15, and doors 90 might be provided between the posts 84, supported upon hinges 87 - allowing cargo access, both from the open longitudinal sides and through the doors 90, when opened.

If a heavier or bulkier cargo 86 is to be carried, the supplementary platform 82 can be lowered, by external crane, or forklift truck to the base platform 81.

Figure 7 shows a transverse end-section through the base platform 81 and supplementary platform 82, in its alternative elevated and lowered conditions.

The base platform 81 has a (continuous or interrupted) floor surface or deck 91, upon cross-beams 93, spanning between side rails 94, in this case of (flange) abutting 'I'- section (steel) beams.

Similarly, the supplementary platform 82 has a (continuous or interrupted) floor surface or deck 102, upon cross-beams 103, spanning between side rails 104.

When fully lowered level, the supplementary platform 82 can be nested to some extent, between the side rails 94.

In this condition, the side rails 104 of the supplementary platform 82 bear on the floor 91 of the base platform 81

A positive interconnection can be preserved, by re-arrangement of the links 89, so that the combined strengths of the supplementary platform 82 and base platform 81 is available to support the cargo 86.

When raised to an intermediate level, the supplementary platform 82 can support cargo 86 independently of the base platform 81.

When fully raised level, the platform 82 can form a roof to protect the cargo 86 from the weather and debris.

Side curtains 72 can be fitted to further protect the cargo 86.

The posts 84 can be made collapsible, by attaching them to the base 81 by pivots 101 (not shown).

Thus, when the supplementary platform 82 is laid upon the base platform 81, the posts 84 can be folded down, to allow compact stacking, for economical transport and storage.

The supplementary platform 82 can be fabricated in more than one assembly, such as one half each of the base length - with intermediate posts fitted to support a transverse joint of the two platform halves.

For deck beam fabrication and co-operative inter-nesting of decks, aside from abutting 'I'-sections, mating 'L'-section beams 201, 202 can be employed, as shown in Figures 19A and 19B.

Thus, say, a pair of opposed L-sections 201, 202, with overlapping (upright) flanges or side skirts 203, 204, selectively secured together by spaced pins 205, to form a 'C'-section or part box girder, can be employed - with advantageous bending moment stress distribution for a given section.

The opposed 'L'-sections can be collapsed - and re-pinned - as shown in Figure 19B.

Reverting to the dedicated vehicle loading configurations of Figures 8 through 17, a multi-deck container 100 has a supplementary deck 112, movably mounted upon a base deck 111, and spanning end support posts 114, through intervening guidance tracks 139.

Figure 8 shows a single vehicle 113 loaded, by driving forward upon a level supplementary deck 112, collapsed upon the base deck 111.

Figure 9 shows one end of the supplementary deck raised to full strut height, to form an inclined loading ramp, which would also allow (single) vehicle reversal loading (as, say, an alternative to the level initial loading of Figure 8).

The single vehicle 113 initially loaded is parked upon a supplementary deck portion 116, temporarily aligned with the rest of the supplementary deck 112, but which can be disengaged therefrom to allow independent tilting, as shown in Figure 10.

Figure 10 shows the lowered end of the supplementary deck 112 raised to an intermediate (say, approximately mid-way) strut height to level the supplementary deck 112 into a shallow incline.

However, the supplementary deck portion 116 is unlatched, to stay tilted with one end on the base deck 111 and the other end carried with the raised supplementary deck.

Having achieved this independent tilt of the supplementary deck portion 116, by a tilting and unlatching sequence, the raised end of the supplementary deck 112 is lowered from full strut height to the base deck 111, to form a shallow inclined ramp for additional vehicles, as shown in Figure 11.

Once the supplementary deck is fully loaded with vehicles, and a vehicle on the tilted portion 116 bridging between decks, the supplementary deck 112 can be levelled as a whole, as shown in Figure 12.

With the supplementary deck 112 overlying it, access to the base deck 111 from one end is unobstructed and vehicle loading can continue - until a full load complement is achieved.

In reviewing the full load capacity, it should be appreciated that a complement of longer vehicles that could otherwise be carried in a given container length can be accommodated by conversion of a container end space into a tilted platform configuration.

Figures 13 through 17 show a similar loading sequence, but adapted for a roof decked container variant - the same references being adopted for corresponding elements.

There are however some points of difference.

Thus in Figure 15 a vehicle is allowed marginally to penetrate the roof deck frame at one end.

In Figure 17, a full load configuration comprises a succession of tilted vehicles 113, spanning

the supplementary and base deck void.

Each vehicle 113 loaded upon a discrete supplementary deck portion 116.

Loading is by an external crane (not shown) and/or by a repeated sequence of supplementary deck 112 raising and lowering, to load incrementally, then unlatch and deploy successive deck portions 116 - repeating the Figure 11 through 13 sequence.

In this full load configuration a lesser number of vehicles that in, say the Figure 12 configuration, is achieved, but vehicles of exceptional length may be accommodated, by vertical inter-nesting.

Although a twin or triple deck configuration has been illustrated, it should be appreciated that, where economics allow, additional decks may be employed, for example in supporting (and preserving from crushing) precious cargo.

Otherwise, it may prove more cost-effective to simply stack loads.

As shown in Figure 20, some temporary expansibility, and/or re-profiling, and/or re-proportioning of container capacity may be achieved, by re-positioning decks.

Thus by, say, raising a supplementary deck 242 to an 'over-reach' position 245 - beyond its passive transit load suspension height 243, provides temporary greater (end) access height 244 for vehicles to a base deck 241.

Moreover, the container open-plan, space-frame or lattice structure itself can accommodate some (albeit temporary) penetration by vehicles during loading of unloading, and under part-loaded deck manoeuvring sequences - in particular for tilting of deck portions and deployment of loading ramps.

Referring to Figure 18, a supplementary deck 152 has end guide arms 153, fitted with pivot rollers 157, (freely) locatable in guide tracks 158, between opposed flanges of support posts 154.

The longitudinal position of the rollers 157 in the tracks 158 is constrained by movable support pins 155 located in through holes 156 at predetermined positions in the support

posts 154.

Thus the deck 152 remains free to pivot about the rollers 157, but is inhibited from moving down the support posts 154, until the support pins 155 are re-located.

The tracks 158 may continue along guide arm extensions 139, as previously described.

Automatic detents or latches 159 for the support pins 155 may be fitted - operative when the end of the supplementary deck 152 reaches a predetermined track position, say, by actuation of the on-board lift rams, whereupon lift can be relaxed (temporarily) and the deck end rested upon the support pins 155.

Withdrawal of the support pins 155 could be effected manually, or by a powered un-latch mode of the detents or latches 159.

Component List

10	container
11	base deck
12	supplementary deck
13	(load) vehicle
14	support posts/struts
15	roof section
16	(supplementary) deck segments/portion
17	pivot connection
18	hinge joint
19	(bulkier/heavier load) trucks/vans
20	(collapsed) container
21	end pivot mounting
22	stack (collapsed containers)
23	roller end mounting / strut interconnection
24	end of supplementary deck

25	intermediate pivot mounting
26	tray (deck 11)
27	actuator ram
28	tray (deck 12)
29	end of supplementary deck
30	(end) access
31	chassis rails (deck 11)
32	chassis rails (deck 12)
33	slots
34	cross-member (deck 12)
35	deck beams
36	diagonal bracing strut
37	diagonal bracing strut
38	cross-member (deck 11)
39	articulated linkage
41	base deck
42	supplementary deck
43	support post/strut
44	base mounting
47	end fitting
48	end fitting
49	articulated linkage
53	support post/strut
54	base mounting
57	mounting position
59	mounting position
63	supplementary side post
67	diagonal bracing
69	bracing arm
72	curtain walling
81	base platform/deck
82	supplementary cargo platform/deck
83	latch
84	support post/strut
85	top rail
86	(load) cargo

87	hinge
88	fastening position
89	links
90	(end) door
91	floor/deck
93	cross-beams
94	side rails
97	end fittings
100	container
101	pivot
102	floor/deck
103	cross-beams
104	side rails
111	base deck
112	supplementary deck
113	(load) vehicle
114	support post/strut
116	(supplementary) deck portion
127	actuator ram
131	deck rails
133	pocket/slot
135	deck beam
139	guidance track
Jx	pivot joint
Jy	pivot joint
152	supplementary deck
153	guide arm
154	support post
155	support pin
156	location hole
157	guide roller
158	guide track
159	latch
201	'L'-section beam
202	'L'-section beam
203	flange

204 flange
205 fastening pin

241 base deck
242 supplementary deck
243 load carriage position
244 loading height span
245 over-reach position

Claims

1.
A multi-deck container (10), comprising
a plurality of relatively movable decks (11, 12),
mounted upon a support structure (14),
for differential relative deck positioning and orientation.

2.
A multi-deck container,
as claimed in Claim 1,
including a common deck support,
through intervening links or guides (39),
to accommodate differential deck span,
upon relative deck inclination.

3.
A multi-deck container,
as claimed in either of the preceding claims,
including a tiltable deck portion (16),
to bridge between adjacent decks,
as a loading ramp or extended load platform.

4.
A multi-deck container,
as claimed in any of the preceding claims,
comprising
a base load deck,
a supplementary load deck,
movable in relation to the base deck,
upon collapsible deck end supports,
between and alongside the decks,
with attendant deck lift, container erection facility.

5.
A multi-deck container,
as claimed in any of the preceding claims,
including a deck segmented
into entrained deck portions,
to allow differential segmental movement,
for diversity of container loading/unloading
and load carriage configurations.

6.
A multi-deck container,
as claimed in any of the preceding claims,
including multiple tiltable deck portions,
to accommodate a succession of discrete loads,
tilted individually between decks.

7.
A multi-deck container,
as claimed in any of the preceding claims,
with selectively detachable deck support,
to accommodate deck tilting,
elevation or support collapse.

8.
A multi-deck container,
as claimed in any of the preceding claims,
with re-locatable deck supports,
for collapse upon a deck.

9.
A multi-deck container,
as claimed in any of the preceding claims,

wherein two or more decks can be integrated,
by relative inward collapse and stacking,
for enhanced load carrying capability.

10.
A multi-deck container,
as claimed in any of the preceding claims,
including a roof deck,
locatable upon deck supports,
and elevatable by deck movement.

11.
A multi-deck container,
as claimed in any of the preceding claims,
including a counterbalanced
deck support mounting,
to facilitate support re-deployment,
for container collapse and erection.

12.
A multi-deck container,
as claimed in any of the preceding claims,
with adaptive deck infill,
for general-purpose or mixed cargo handling,
and incorporating between-deck bracing links, intermediate deck end supports.

13.
A multi-deck container,
as claimed in any of the preceding claims,
incorporating an integral deck lift,
operable between decks.

14.
A multi-deck container,
as claimed in any of the preceding claims,
including a deck lift,
offset from the deck centre of gravity,
for counter-balanced deck tilt.

15.
A multi-deck container,
as claimed in any of the preceding claims,
with an end access,
through deck end supports,
for drive-on cargo loading.

16.
A multi-deck container,
substantially as hereinbefore described,
with reference to, and as shown in,
the accompanying drawings.

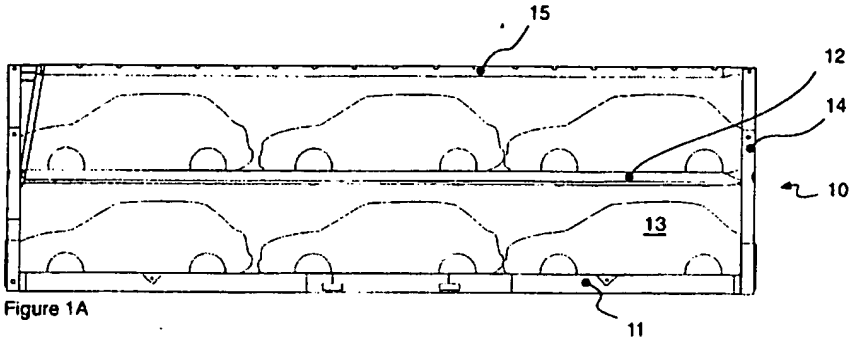


Figure 1A

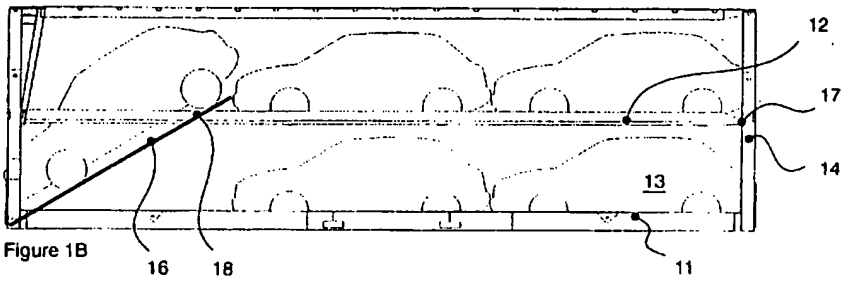


Figure 1B

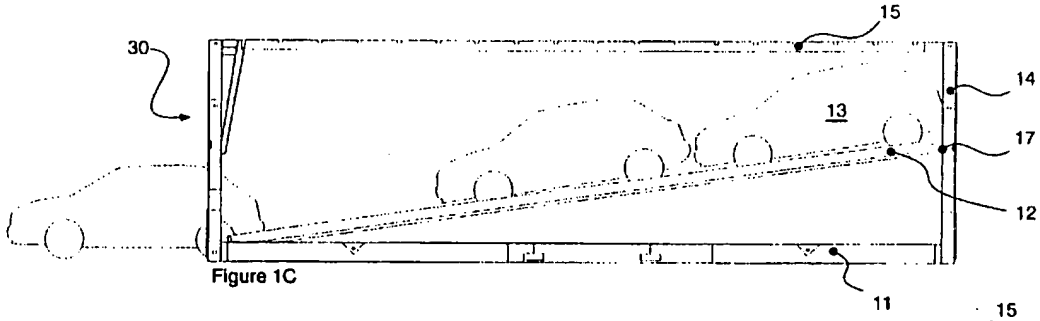


Figure 1C

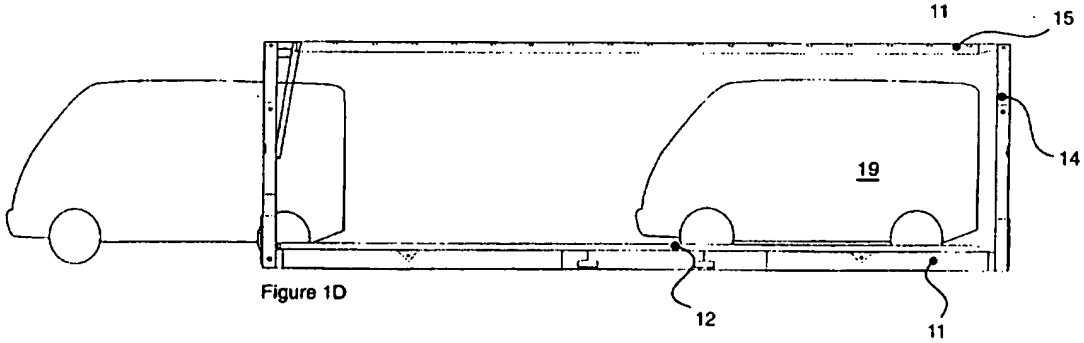


Figure 1D

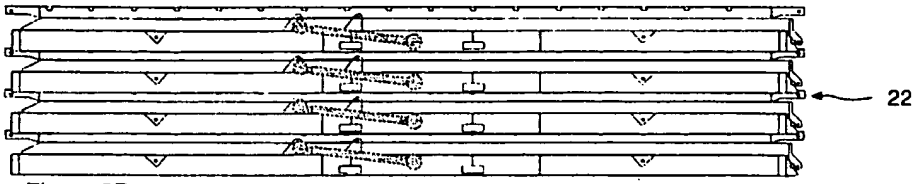


Figure 2B

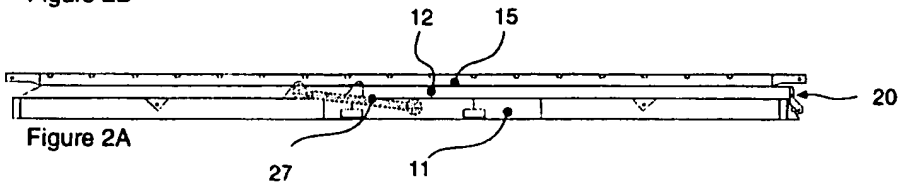


Figure 2A

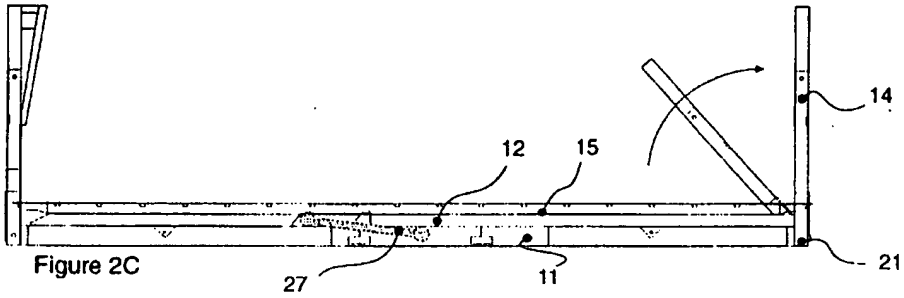


Figure 2C

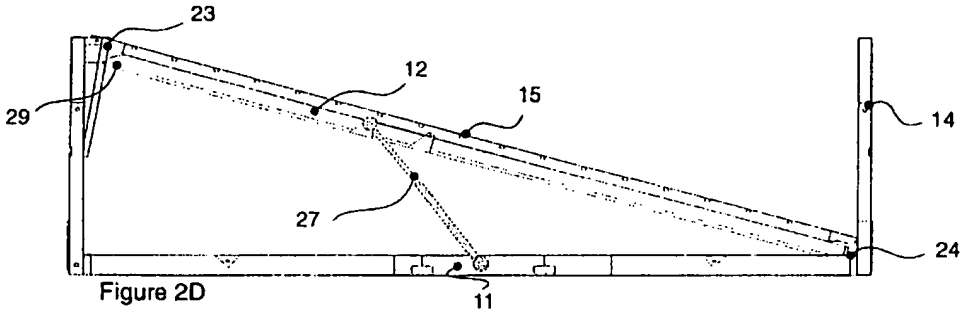


Figure 2D

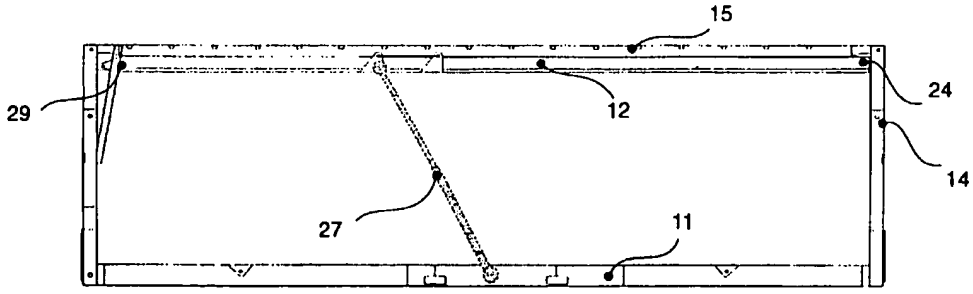
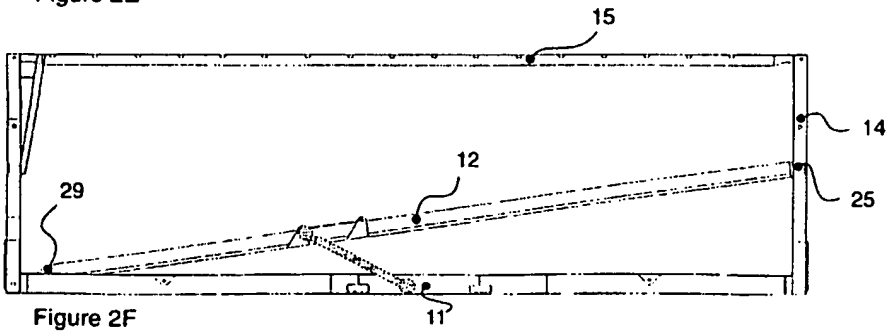


Figure 2E



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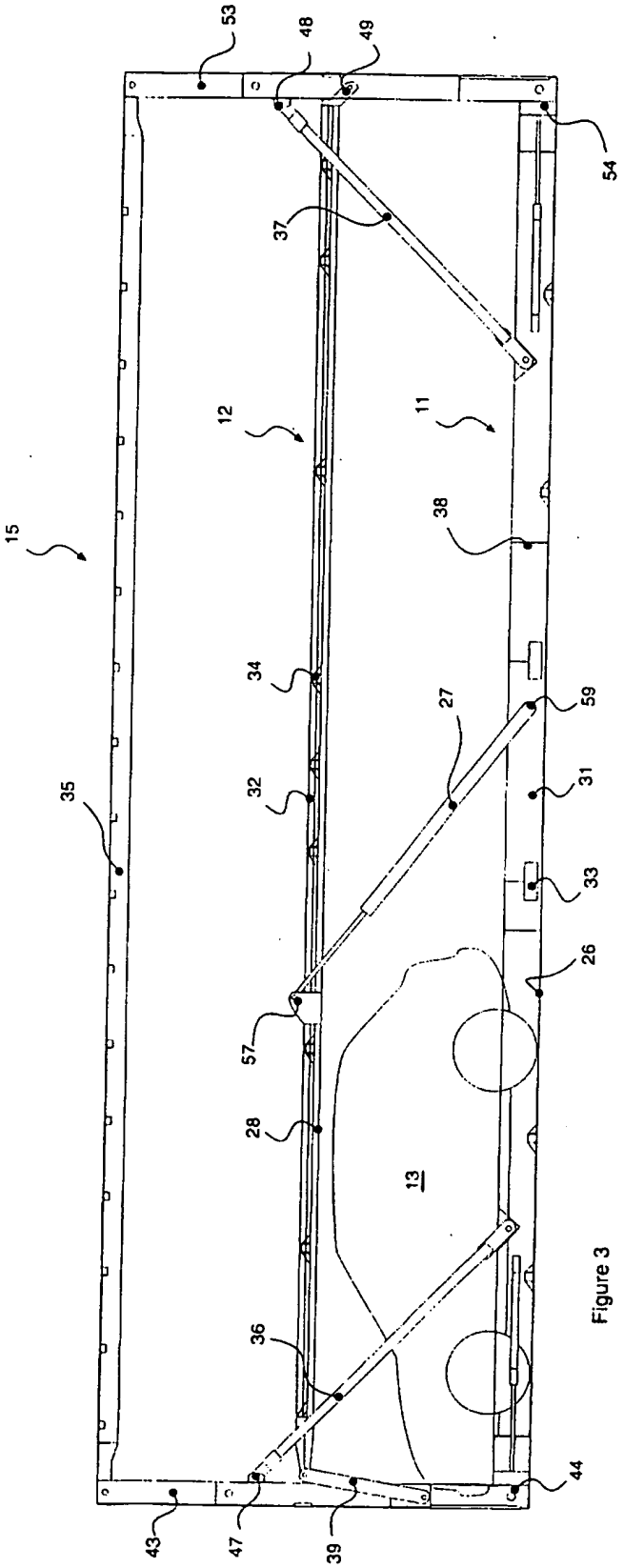
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Figure 3

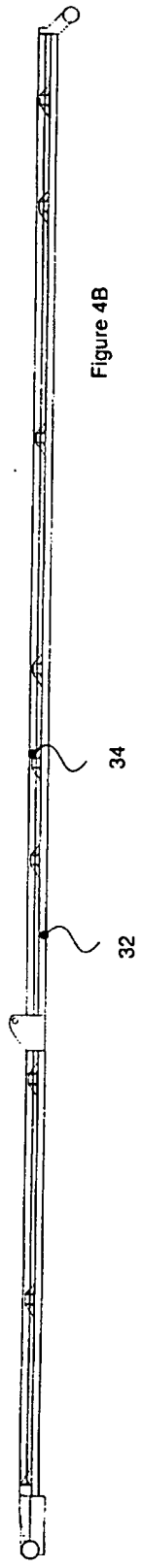


Figure 4B

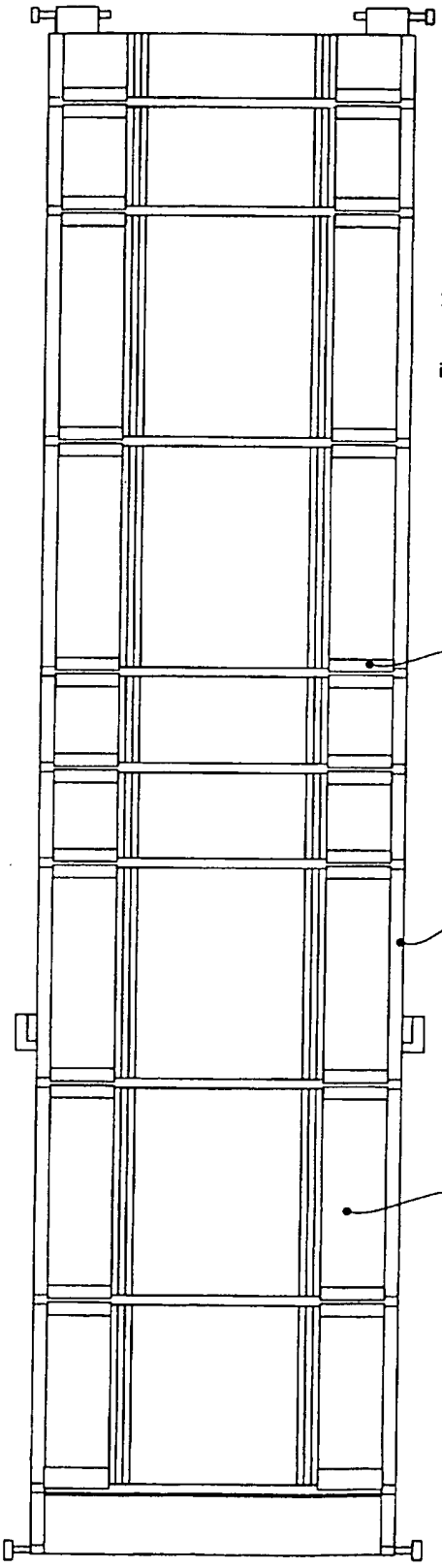


Figure 4A

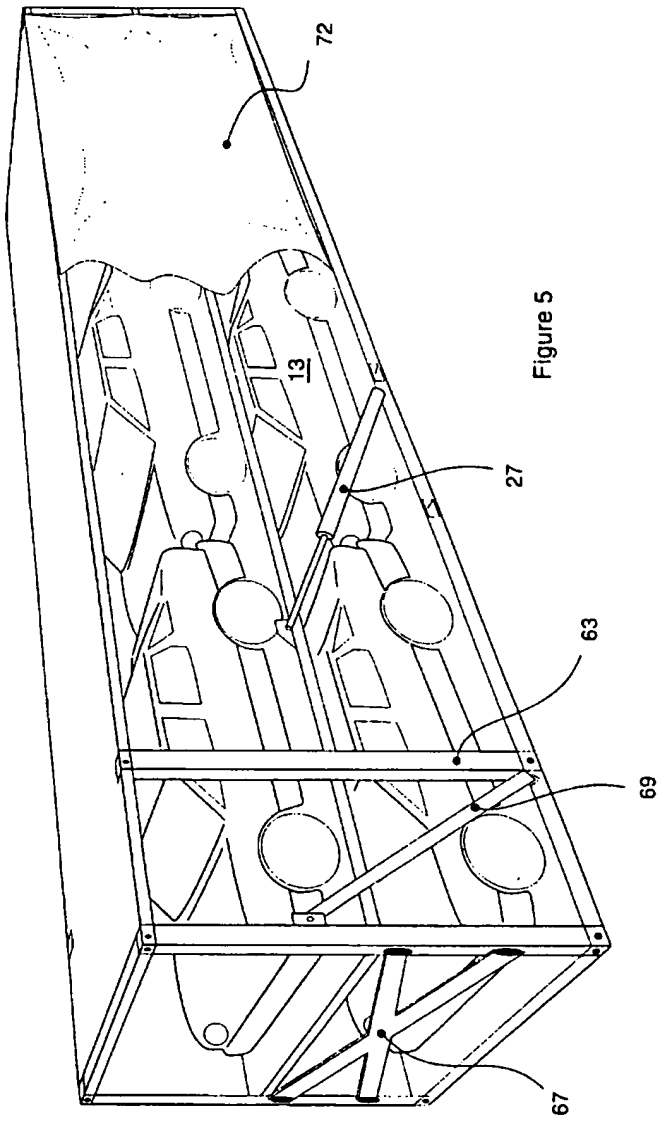


Figure 5

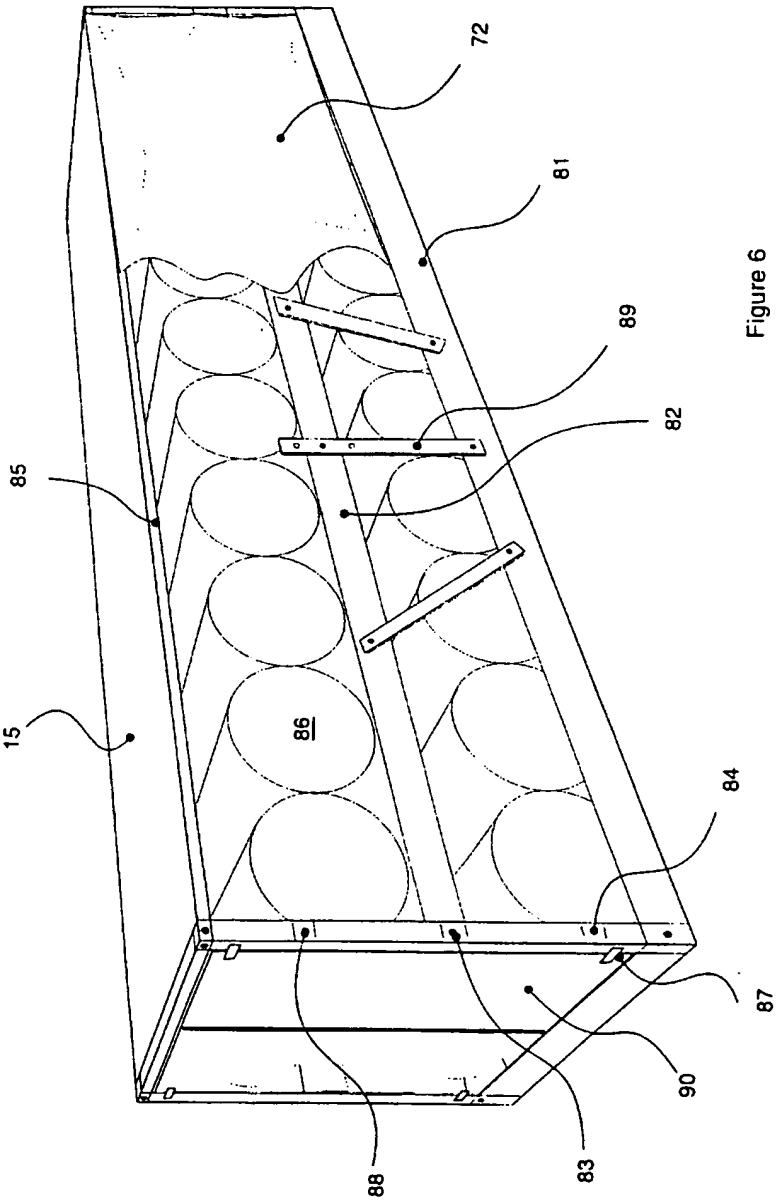
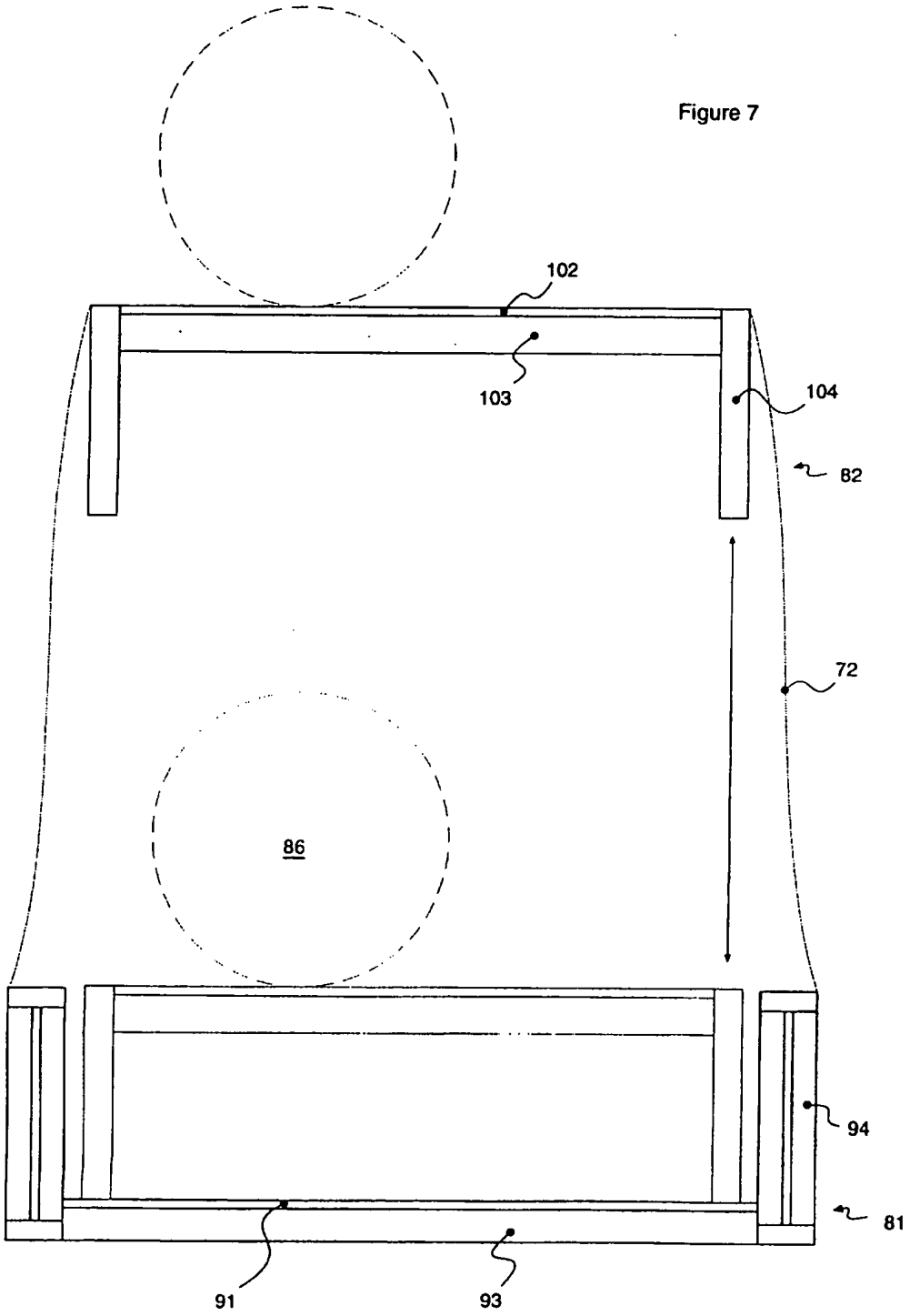
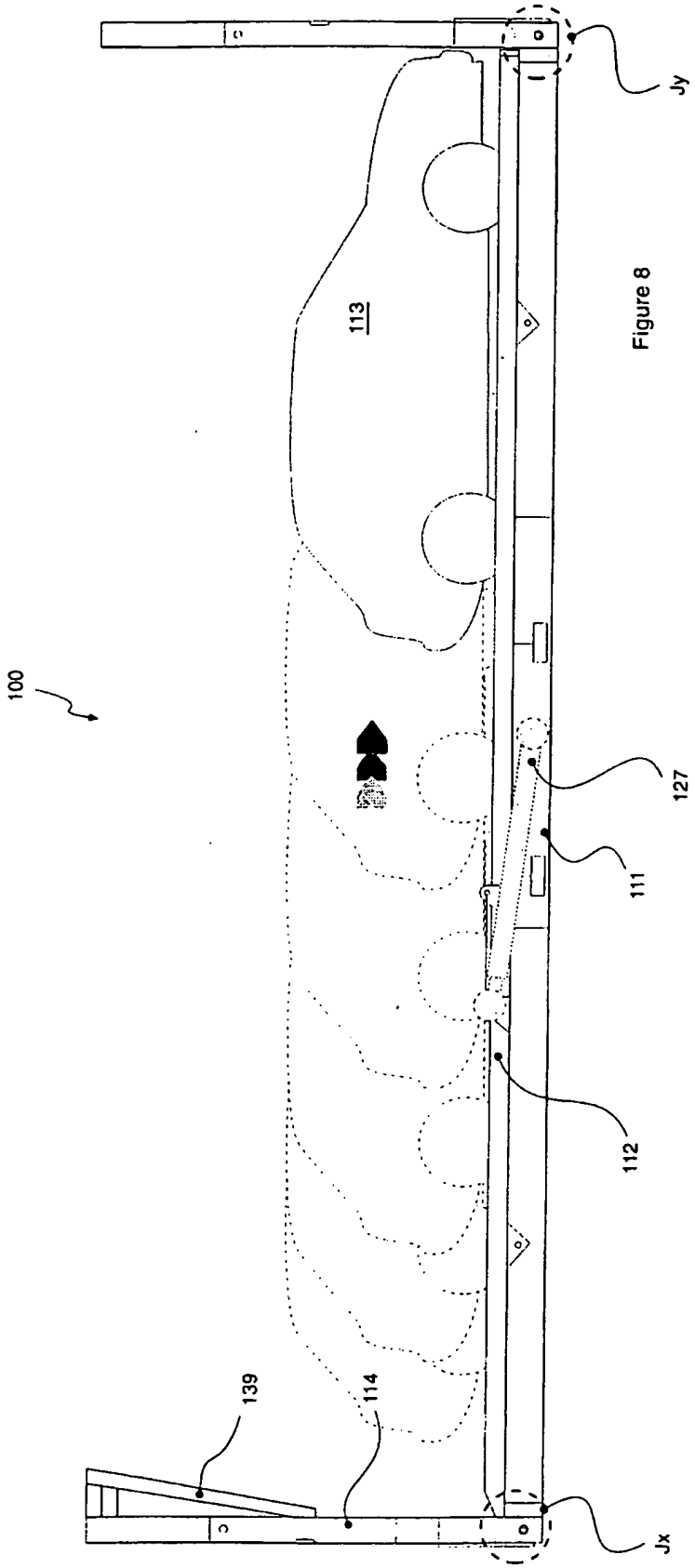


Figure 6

Figure 7





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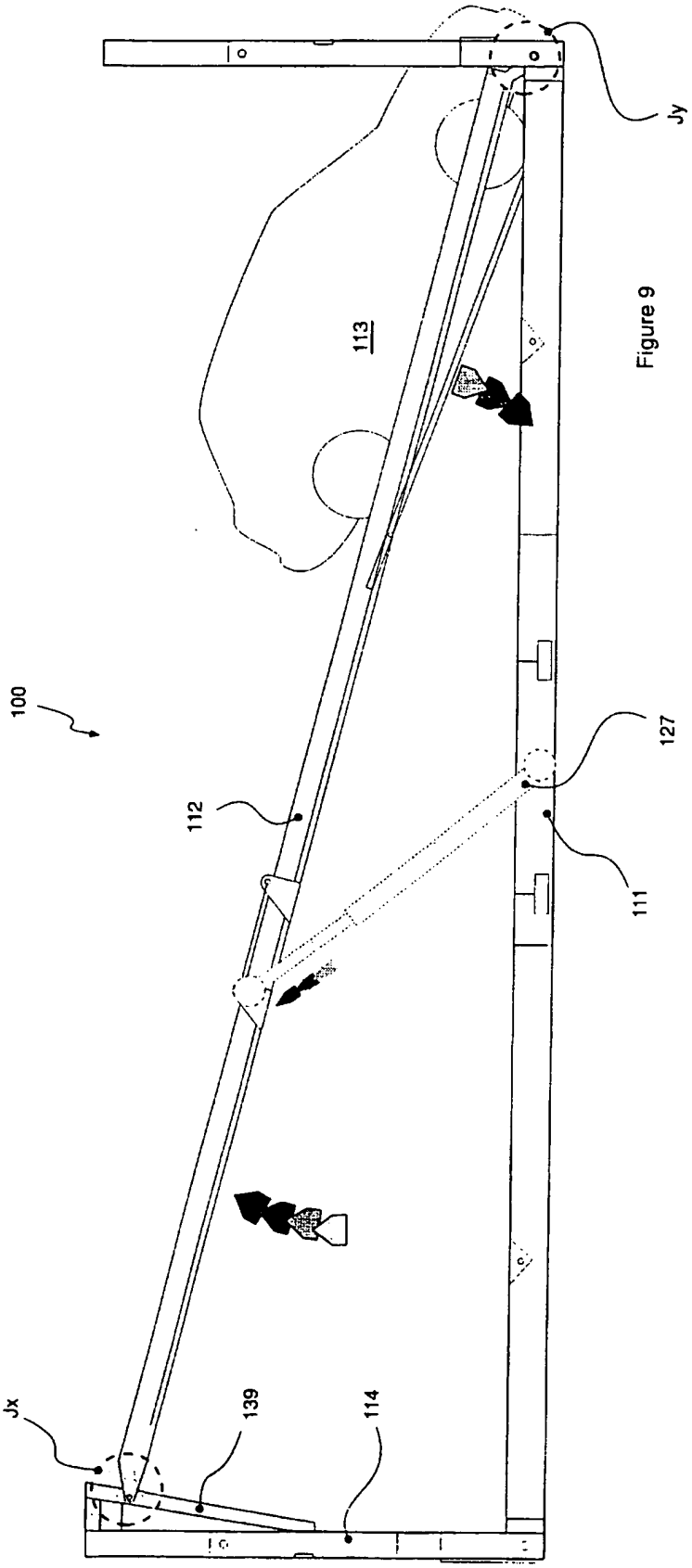

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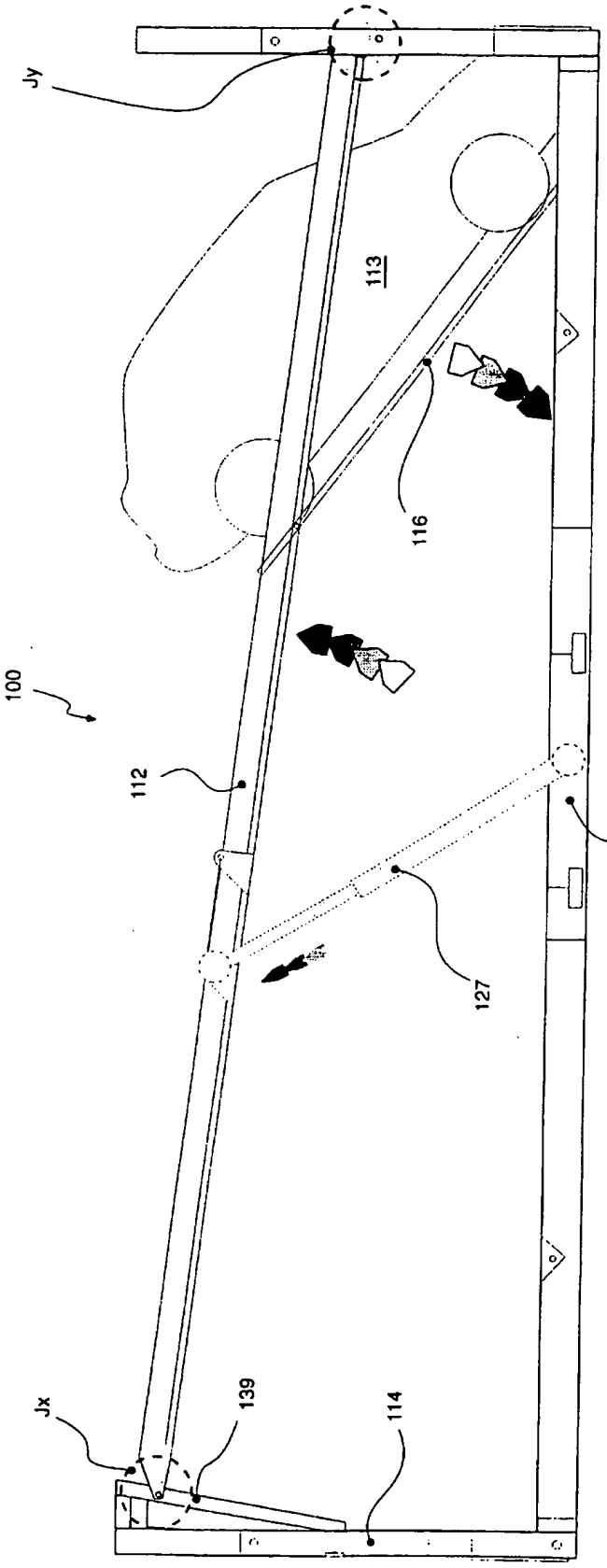
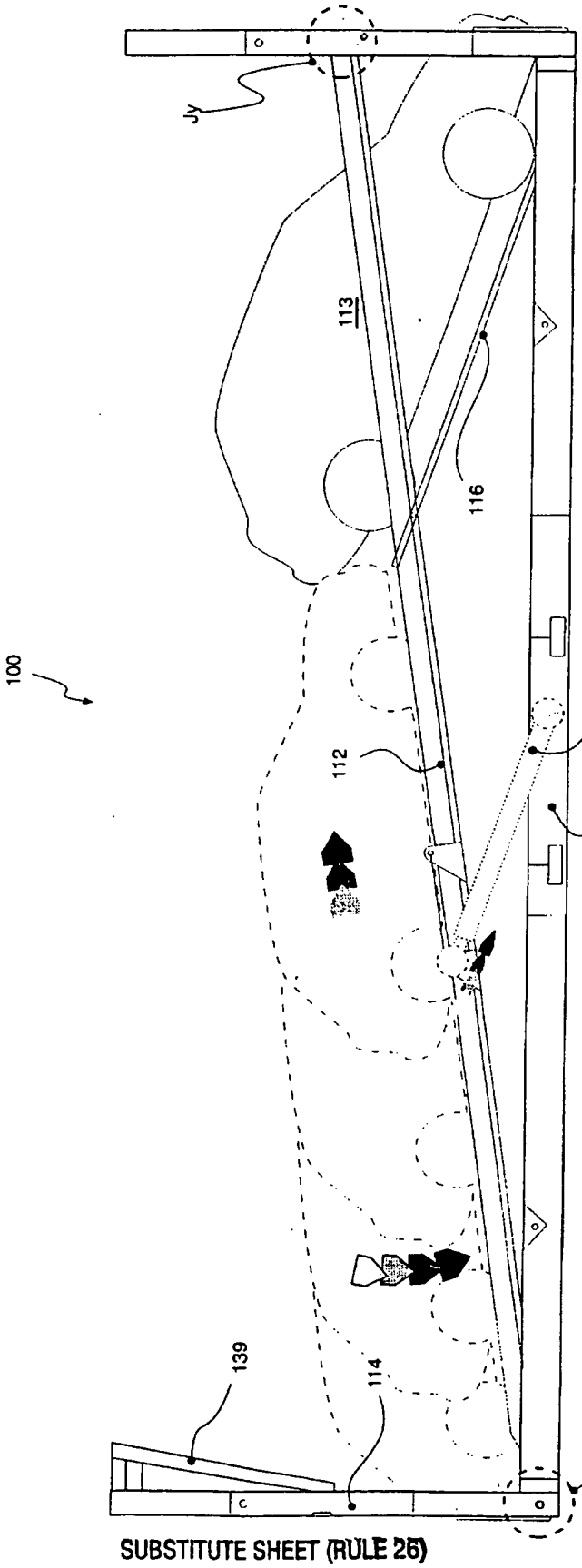


Figure 10



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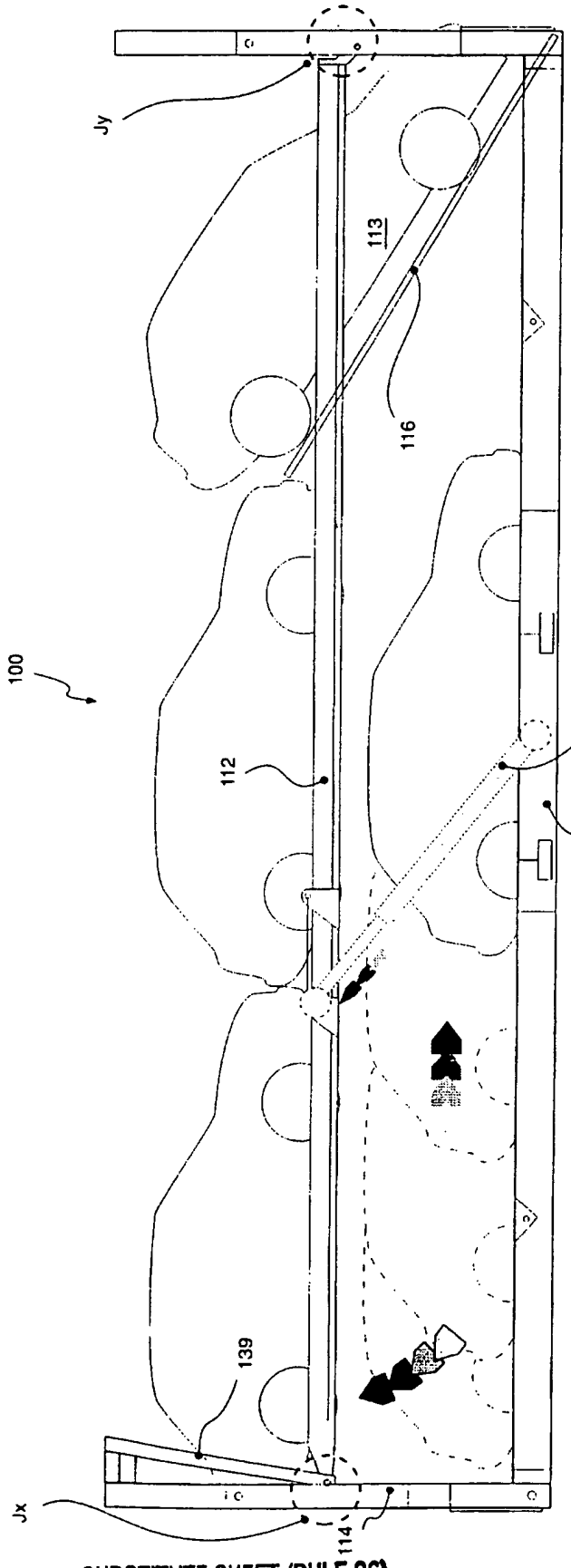

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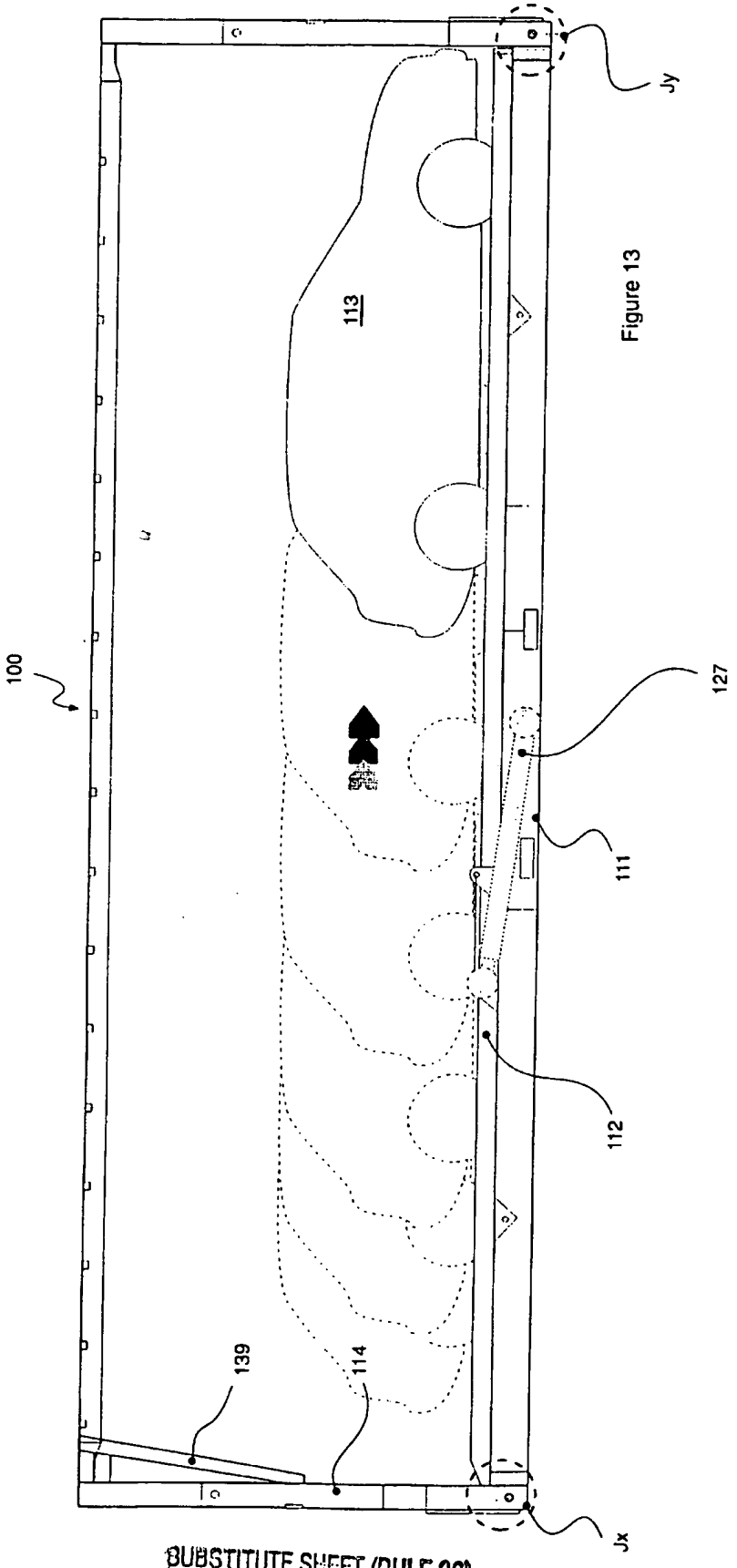

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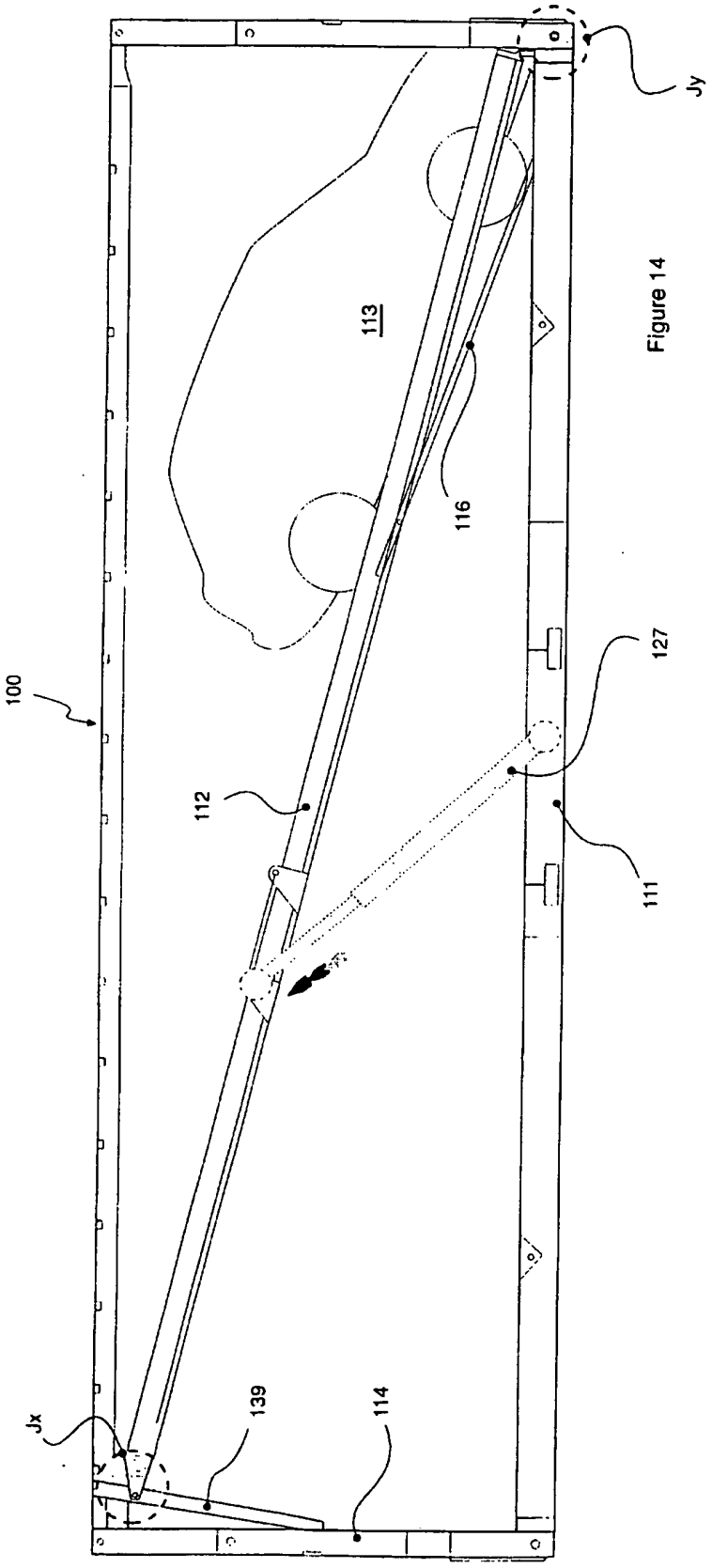


Figure 14

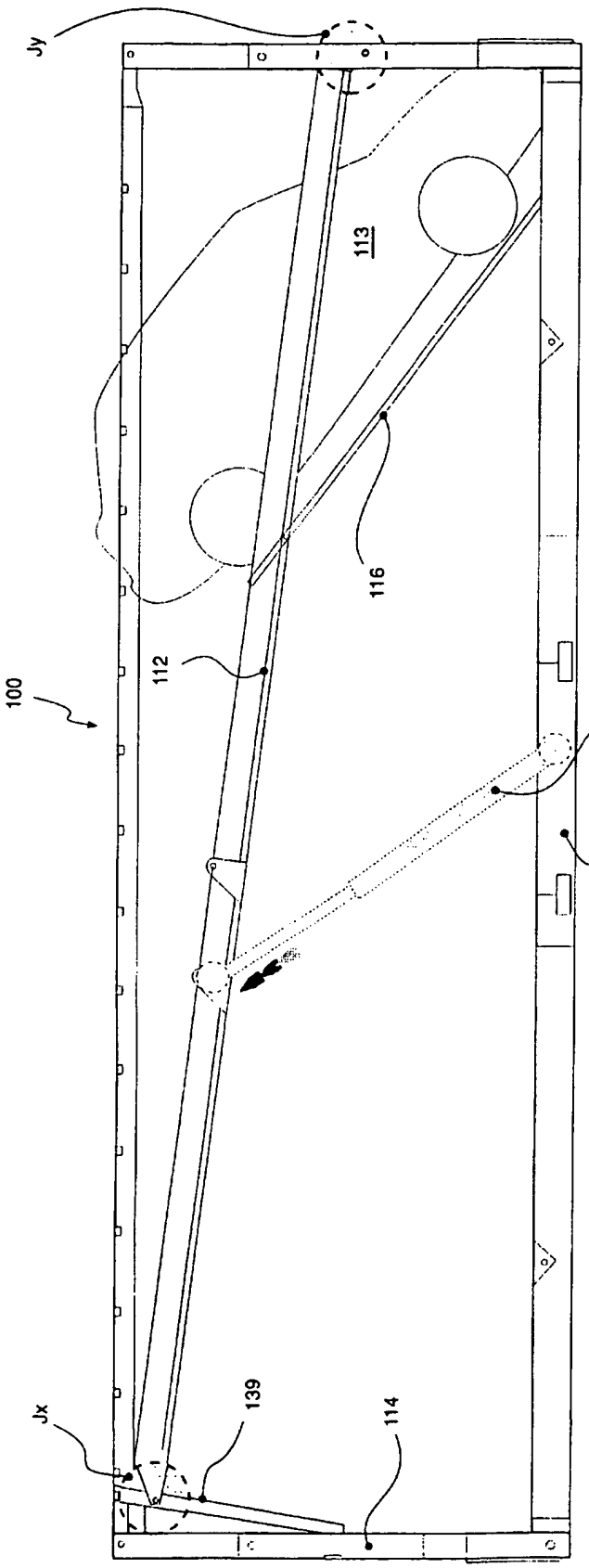
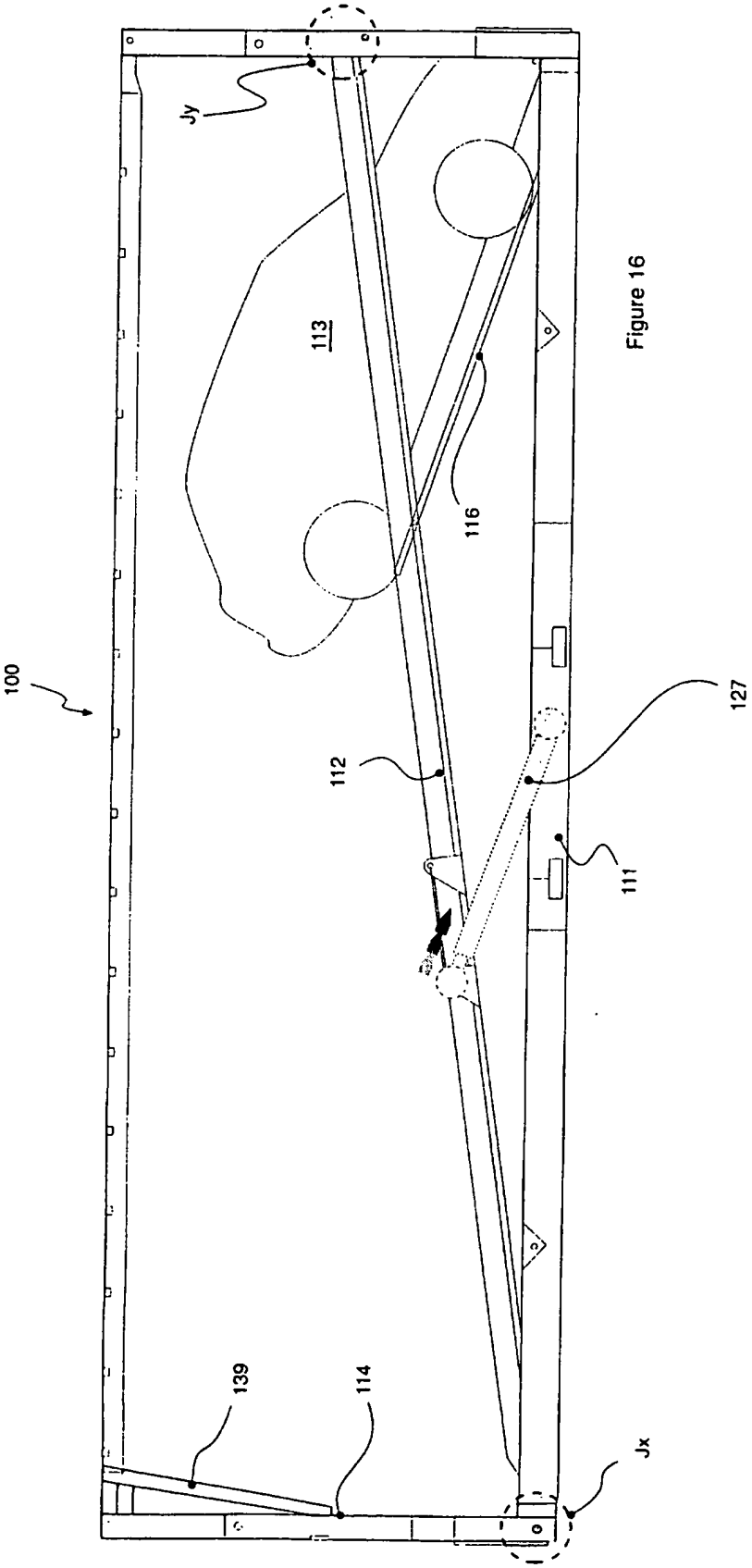


Figure 15



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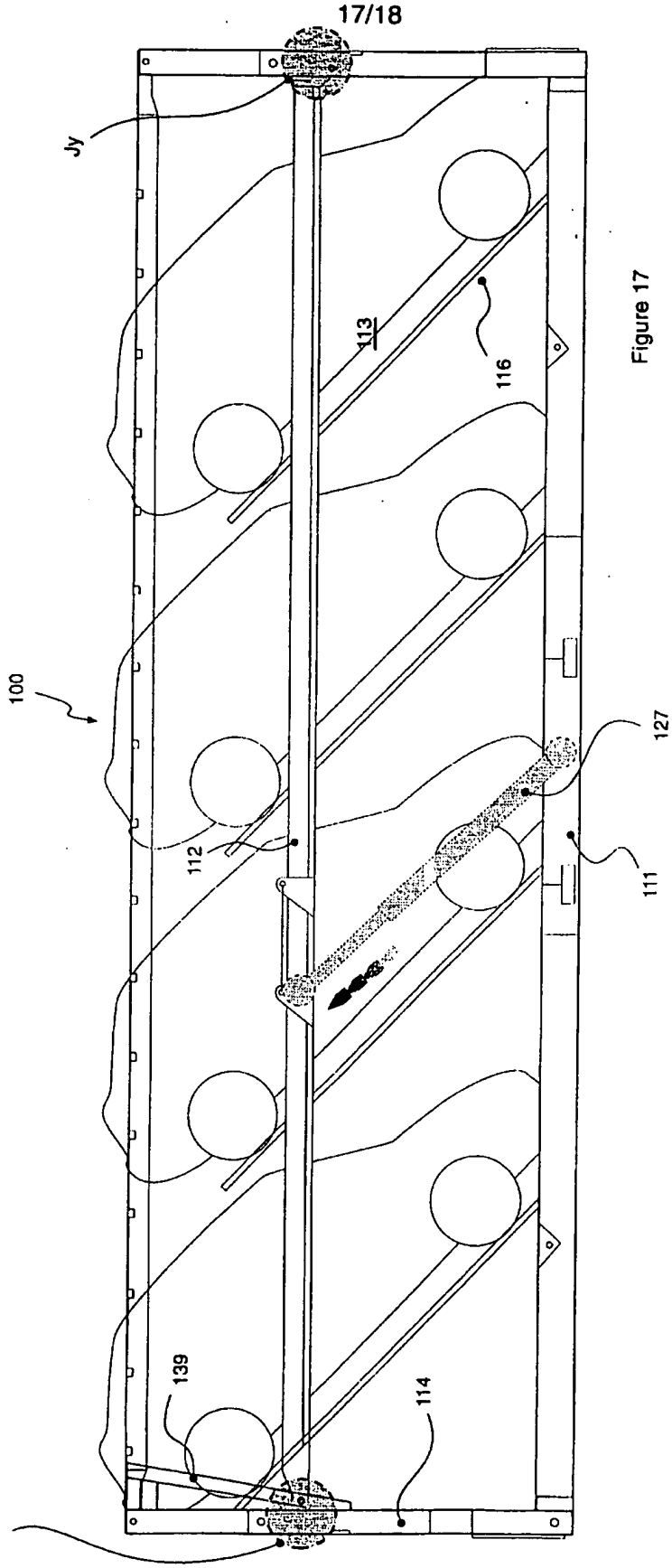

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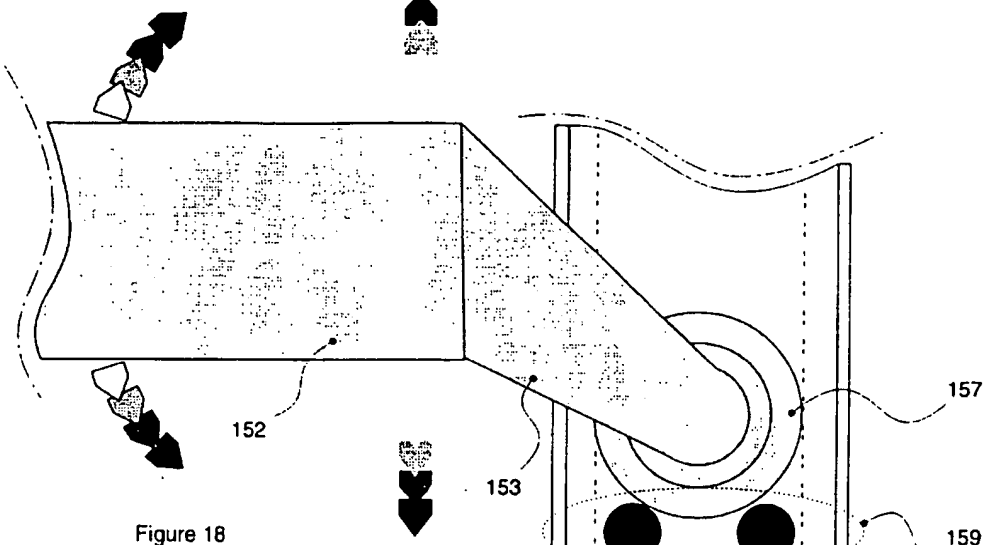


Figure 18

Figure 19A

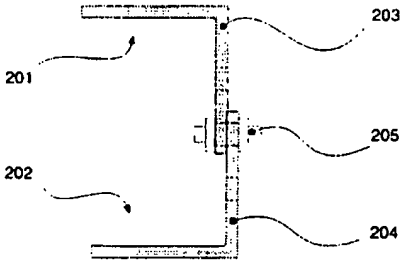


Figure 19B

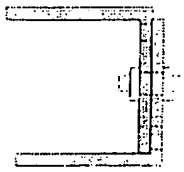
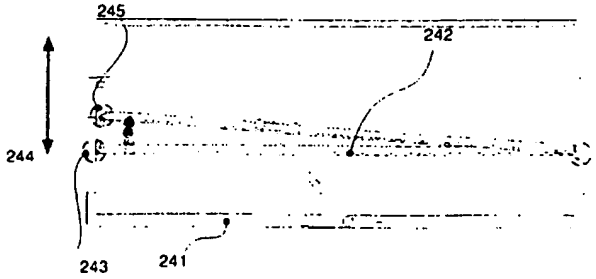


Figure 20



INTERNATIONAL SEARCH REPORT

rnational Application No
PCT/GB 97/02319

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65D88/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65D B60P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 003, no. 093 (M-068), 8 August 1979 & JP 54 067939 A (NISSAN MOTOR CO LTD;OTHERS: 01), 31 May 1979, see abstract ---	1-16
X	GB 1 580 706 A (WARDELL TRANSPORT LTD) 3 December 1980 see the whole document ---	1-16
X	DE 11 34 334 B (E. LICHTENFELD) 2 August 1962 see the whole document ---	1-16
A	US 5 526 940 A (SHEA MICHAEL D ET AL) 18 June 1996 --- -/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

' Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
2 December 1997	09/12/1997

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European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Beernaert, J

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